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REVIEW OF THE LATEST TECHNOLOGY IN CARTOGRAPHIC DATA ACQUISITION, MANIPULATION, STORAGE AND PRESENTATION, WITH SPECIAL EMPHASIS ON POTENTIAL APPLICATIONS IN DEVELOPING COUNTRIES: AUTOMATED MAPPING PROJECTS: DEVELOPMENT AND APPLICATION OF DIGITAL CARTOGRAPHIC DATABASES, INCLUDING DIGITAL TERRAIN MODELLING

Designing a new National Atlas of the United States

Paper submitted by the United States of America**

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INTRODUCTION

The U.S. Geological Survey (USGS) and other agencies of the Federal Government have amassed a large volume of earth science and other geospatial data, but these data sets are not easily accessible and useable together. The *National Atlas* provides a mechanism to bring diverse national-level data sets together in a way that has not been done before. The project depends on the participation of nongovernmental partners to provide consumer-level geographic information system (GIS) software, assistance with publication formats and marketing strategies, and development of widespread sales and distribution networks.

PRODUCT DESIGN

The *National Atlas* project will use GIS technology to bind together diverse sets of geospatial information into definitive information resources and to furnish uniform access capabilities to display and analyze the data. *National Atlas* products would use GIS data viewing and analysis tools combined with definitive sets of geographic reference, thematic, and statistical data to provide users with the capability to make their own maps. Users will have the flexibility to select, combine, symbolize, and display the data sets of interest to them. Printed maps of visually interesting and relatively stable subject matter (for example, image map of the United States, shaded relief, land cover, surficial geology, roads, drainage and political boundaries) may be sold separately or bundled with CD-ROM products. In addition, Internet access to USGS data sets would allow users to get the latest information on earthquakes, stream flow rates, and other events where knowledge is time-sensitive. World Wide Web (WWW) pages would describe atlas content, provide graphic examples, and enable electronic ordering.

A successful public and private partnership will enable the *National Atlas* project to provide two key outputs:

> A set of integrated, consistent, and authoritative data that can be used to answer a wide variety of questions regarding the physical and societal conditions of the Nation. These data will be conveyed to the users through various media, including CD-ROM's, WWW pages, and printed maps.
>
> A geographic information system tool that can be used to display and analyze a wide variety of geospatial data. The provision of this standard tool will encourage other data producers to take advantage of its capabilities and to offer their data in a form that can be used with the existing national level data sets or with sets of regional or site-specific data.

A key feature of the *National Atlas* is that the data sets will be processed so that different themes of information can be combined, displayed, and analyzed together. This requires that the data are geographically registered to the same coordinate system, are of comparable spatial resolutions, and are logically consistent. Many of the desirable data sets exist in digital form but need further processing to ensure consistency between data sets. The data sets to be provided by the USGS include the following types of information relating to:

highway systems (with route numbers)
rail systems
river systems (with names)
populated places
Federal lands
elevation (relief)
land cover and land surface images
sea floor images (Exclusive Economic Zone)
surficial and bedrock geology
mineral occurrences
organic fuels
geophysics
land forms
geochemistry
faults and historic seismicity
marine and sea floor characteristics
coastal erosion
surface and ground water
water use and quality

In addition, major sets of geospatial data will be obtained through partnerships with other Federal agencies, including the following:

Department of the Interior (public lands, wetlands data)
National Oceanic and Atmospheric Administration (climate and geophysical data)
Environmental Protection Agency (environmental data)
Bureau of Transportation Statistics (roads, railroads)
Department of Agriculture (soils, forest data)
Bureau of the Census (political boundaries, Congressional districts, socioeconomic, agricultural, and demographic data)
Bureau of Labor Statistics (economic data)
Other agencies that collect relevant statistical data

The first planned product will be a CD-ROM containing various digital data sets linked to the GIS software. Information from the Internet and printed maps will follow. After the first release, subsequent CD-ROM and printed folio editions will include newly available data sets. Editions based on States or national regions are also possible.

USER NEEDS

The *National Atlas* project addresses the needs of three user communities: the educational sector, the general public, and the public policy sector. Specific products and groups of products can be tailored and targeted for several markets. The potential for outreach into the educational sector is great. In addition to being available in public and school libraries, the data and GIS capabilities could be used in geography curricula in K-12 classrooms to meet the National Geography Standards. Success in the educational sector would augur well for success in marketing to the reference work segment of the general public. The geographically referenced earth science and statistical data, available for display and manipulation in the *National Atlas*, would support informed public policy decision making. Widespread use of *National Atlas* products by those in the public policy field would create an influential constituency for project support.

PRODUCTION REQUIREMENTS

The USGS has two unique capabilities that complement the expertise of private sector partners in the production of the *National Atlas*:

Provider of credible data sets - Data provided in the *National Atlas* should be authoritative; this is difficult for a private sector firm to achieve without close collaboration with the appropriate government authorities. The USGS will act as a "data consolidator" in arranging cooperative agreements with other government agencies for data on a certain theme; it will ensure that the data sets are appropriate for that theme and can be used with related data. The USGS is in a unique position to perform this data collection, evaluation, and integration.

Expertise in GIS and digital cartography - The project will require personnel skilled in creating GIS applications software, in developing digital data bases related to their disciplines, and in knowing how these data can be combined. Likewise, it will require experts in the appropriate scientific methods needed to analyze the data sets. Also needed will be experts in the cartographic display of the data sets. The USGS has personnel with these various skills, thus enabling private firms to bring more innovative technology and richer data sets to the market in a shorter timeframe.

The project depends on nongovernmental partners to provide user-friendly GIS software, to assist with publication formats and marketing strategies, and to develop a widespread sales and distribution network. Private sector skills in identifying specific target markets and developing appropriate products are key facets of this program.

Marketable products are expected as early as May 1998. The dates and nature of the initial products will be the subject of analysis and negotiation between the USGS and the private sector firms. Subsequent editions are planned to incorporate more comprehensive data sets and (or) GIS technology. State or regional editions, incorporating more detailed spatial data, are possible as part of an expanded product line.

PROTOTYPE DESIGN

The USGS has developed a working prototype of the electronic *National Atlas*. The prototype uses a simple user interface to select and manipulate a sampling of national data sets. Work on the prototype has enabled us to gain experience in developing the user interface, demonstrate to potential partners the functions envisioned for the atlas, begin integrating national digital data sets, develop preliminary design and functional specifications, and receive feedback from interested parties. Figure 1 shows the opening screen and pull-down menu bars. (The *National Atlas* displays are in color; the figures here are reduced in size and shown in black and white)

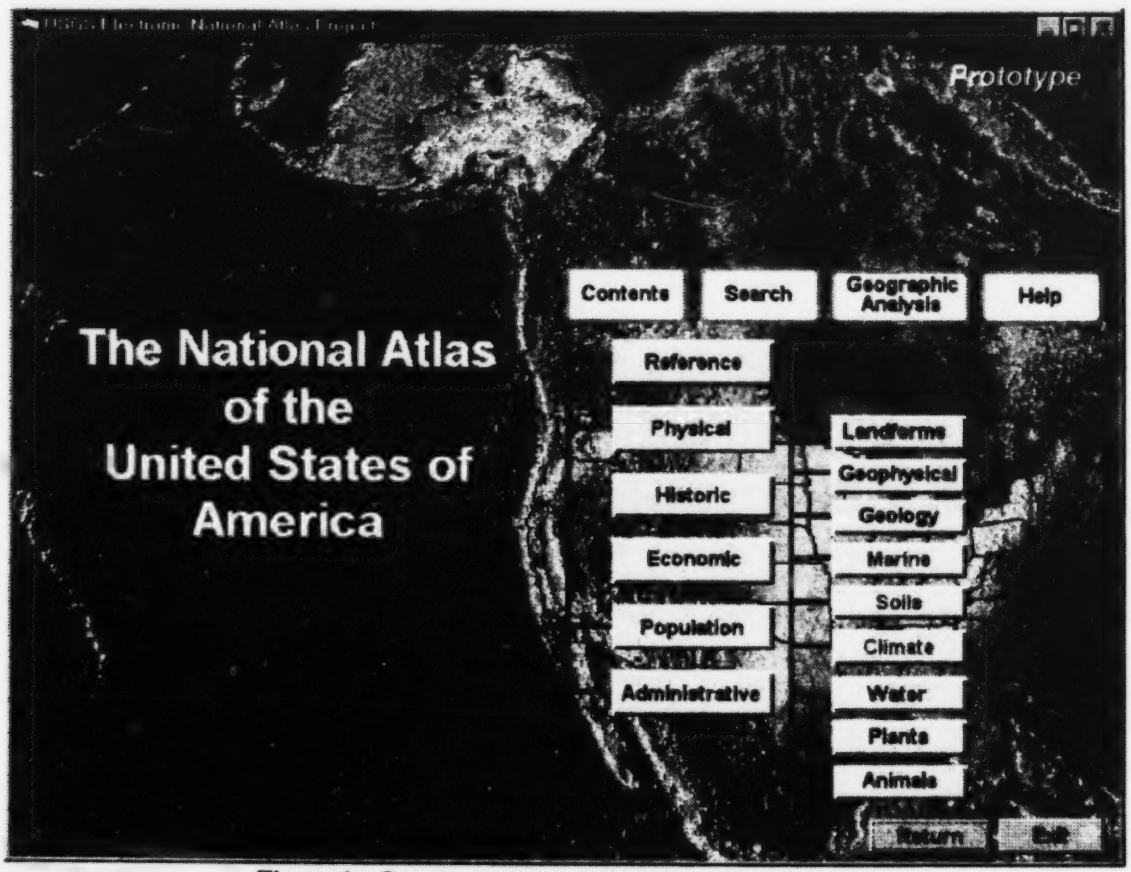

Figure 1. Opening screen of *National Atlas* prototype.

/...

Figure 2 shows descriptive text about one of the data themes (physical - fauna) and large choice buttons allowing the user to display map data and metadata, access a multimedia presentation, or link to the World Wide Web.

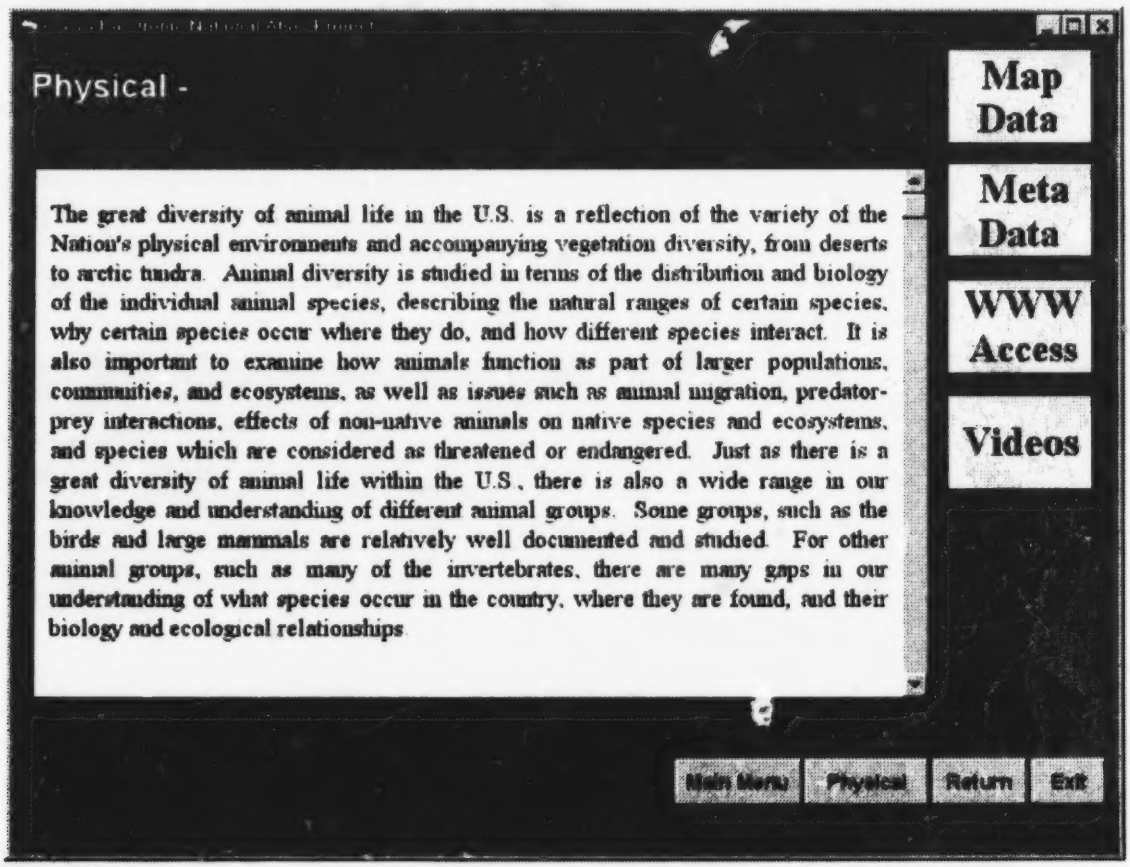
Physical -
Map Data
Meta Data
WWW Access
Videos
The great diversity of animal life in the U.S. is a reflection of the variety of the Nation's physical environments and accompanying vegetation diversity, from deserts to arctic tundra. Animal diversity is studied in terms of the distribution and biology of the individual animal species, describing the natural ranges of certain species, why certain species occur where they do, and how different species interact. It is also important to examine how animals function as part of larger populations, communities, and ecosystems, as well as issues such as animal migration, predator-prey interactions, effects of non-native animals on native species and ecosystems, and species which are considered as threatened or endangered. Just as there is a great diversity of animal life within the U.S., there is also a wide range in our knowledge and understanding of different animal groups. Some groups, such as the birds and large mammals are relatively well documented and studied. For other animal groups, such as many of the invertebrates, there are many gaps in our understanding of what species occur in the country, where they are found, and their biology and ecological relationships.
Main Menu
Physical
Return
Exit

Figure 2. Navigation of a data theme.

Figure 3 shows a simple map display including shaded relief, roads, lakes, and streams. Menu buttons along the top of the window allow the user to add more data and perform various specialized functions, such as overlay analysis and buffer generation.

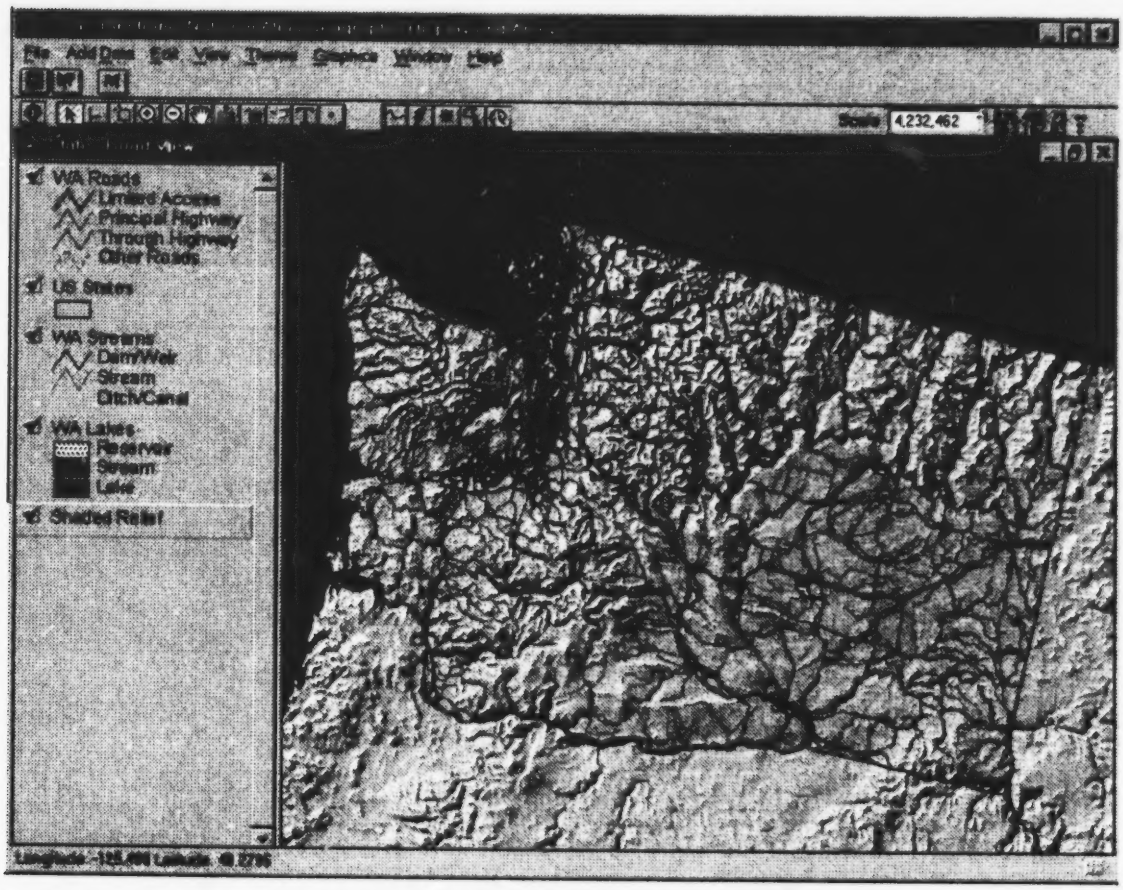

Figure 3. *National Atlas* map display.

Figure 4 shows the results of a query of a gazetteer containing about 2 million names. In addition to information about the characteristics of the named feature, a map showing its location is displayed.

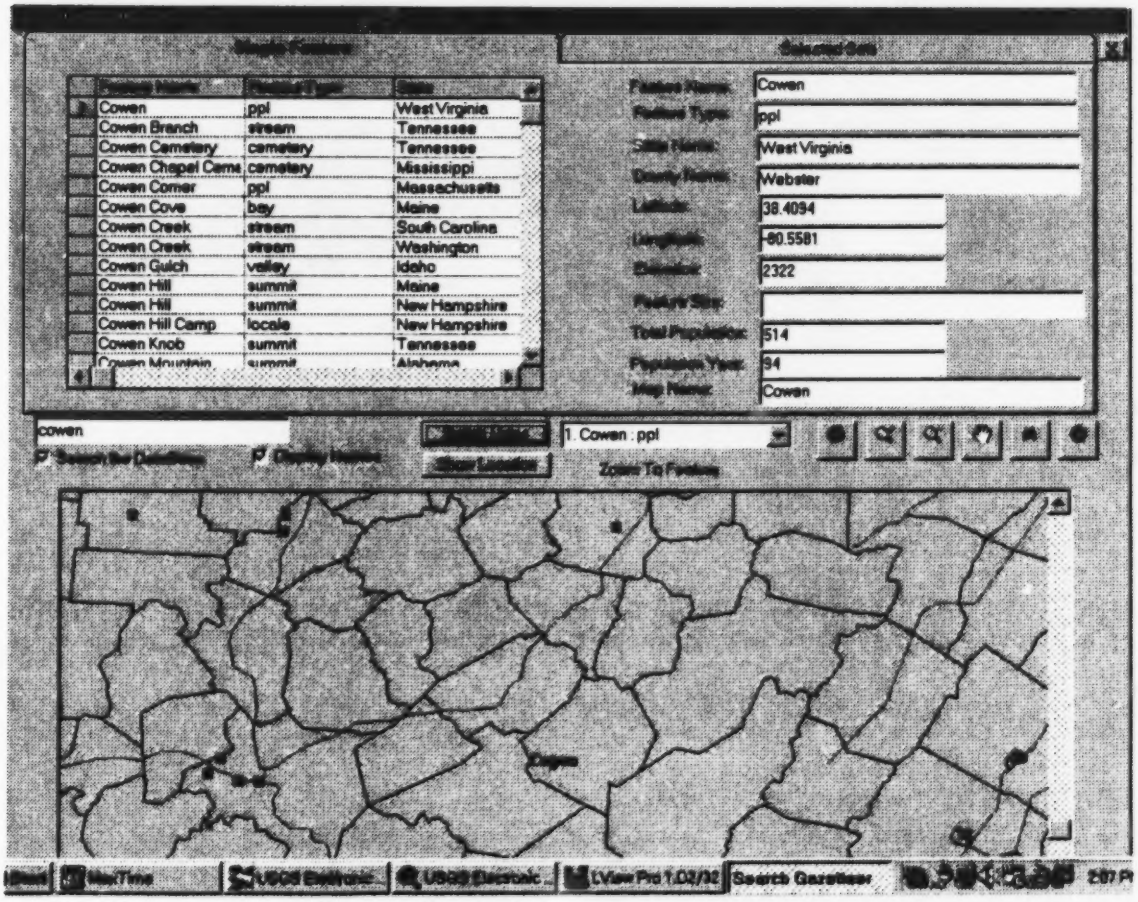

Figure 4. Results of gazetteer query.

Figure 5 shows a part of a data base for all of the national parks, with links to map data and WWW pages. The Internet link would allow users to find out information on the latest park activities and conditions.

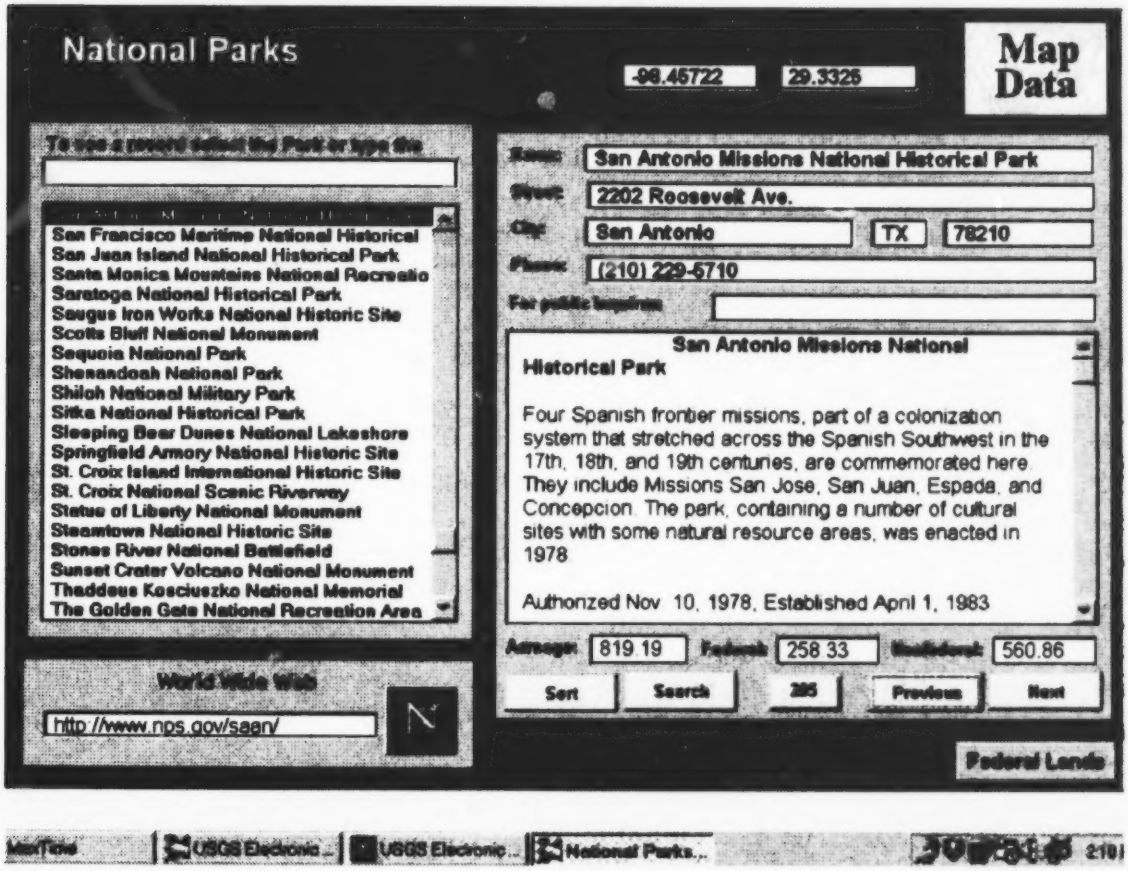
National Parks
-98.45722
29.3326
Map Data
San Francisco Maritime National Historical
San Juan Island National Historical Park
Santa Monica Mountains National Recreatio
Saratoga National Historical Park
Saugus Iron Works National Historic Site
Scotts Bluff National Monument
Sequoia National Park
Shenandoah National Park
Shiloh National Military Park
Sitka National Historical Park
Sleeping Bear Dunes National Lakeshore
Springfield Armory National Historic Site
St. Croix Island International Historic Site
St. Croix National Scenic Riverway
Statue of Liberty National Monument
Steamtown National Historic Site
Stones River National Battlefield
Sunset Crater Volcano National Monument
Thaddeus Kosciuszko National Memorial
The Golden Gate National Recreation Area
San Antonio Missions National Historical Park
2202 Roosevelt Ave.
San Antonio
TX
78210
(210) 229-5710
San Antonio Missions National
Historical Park
Four Spanish frontier missions, part of a colonization system that stretched across the Spanish Southwest in the 17th, 18th, and 19th centuries, are commemorated here. They include Missions San Jose, San Juan, Espada, and Concepcion. The park, containing a number of cultural sites with some natural resource areas, was enacted in 1978
Authorized Nov 10, 1978, Established April 1, 1983
819 19
258 33
560.86
Sort
Search
Previous
Next
Federal Lands
http://www.nps.gov/saan/
USGS Electronic...
USGS Electronic...
National Parks...

Figure 5. Query of a national parks data base.

The prototype is being used in a variety of customer evaluation and testing situations to help design a compelling product. In this version of the prototype, data sets are stored on CD-ROM and the application software runs on the local (client) machine. Internet capabilities allow the seamless

integration of more current or additional attribute information with that contained on the CD-ROM. Alternate designs, where more data and software functionality reside on network servers, also are being evaluated.

CONCLUSION

The *National Atlas* project provides a showcase for geospatial data and mapping technology. The project will increase awareness not only of the geospatial information collected and analyzed by the USGS and other agencies, but also of the use of GIS technology in the display and analysis of geographically referenced statistical data. The project will benefit from a synergistic relationship between the public and private sectors in the production of the *National Atlas*. The real beneficiaries will be the atlas users, who will be able to readily access and use large amounts of geospatial information about our country.